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EP 0542168 A1 WO 93/10658 A1 BE 000899371 A
US 3727723 A

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(54) Abstract Title
Portable mast climbing device

(57) A portable mast climbing device for deploying streetlights, CCTV cameras or traffic signs on lamp posts or poles comprises motor 10 coupled to drive friction wheel/roller 12 and a guide apparatus which in use embraces the opposite side of a mast to and is vertically displaced with respect to wheel 12 wherein wheel 12 is biased against the mast and controls the position of the climbing device. The guide apparatus preferably comprises a pair of rollers 2 on an adjustable V-shaped support 3 that can be locked in position by pin 4. A second rotatable guide apparatus 6 may be provided which is located directly opposite wheel 12 and biased against the mast by springs in section 7. Roller 12 is preferably connected to motor 10 by worm-drive gearbox 11 and may be remote controlled.

FIGURE 2

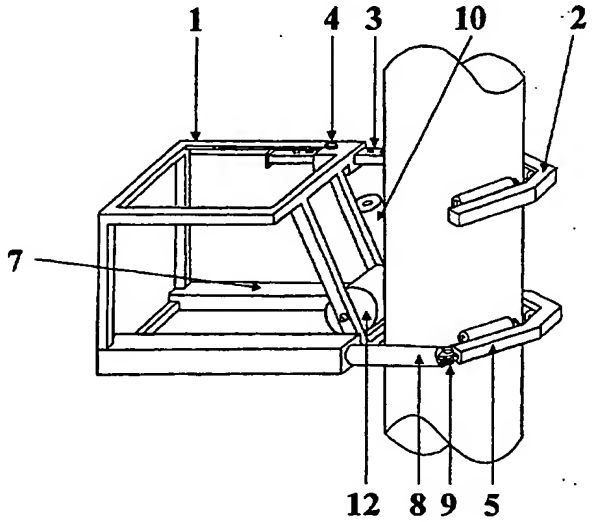

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FIGURE 1

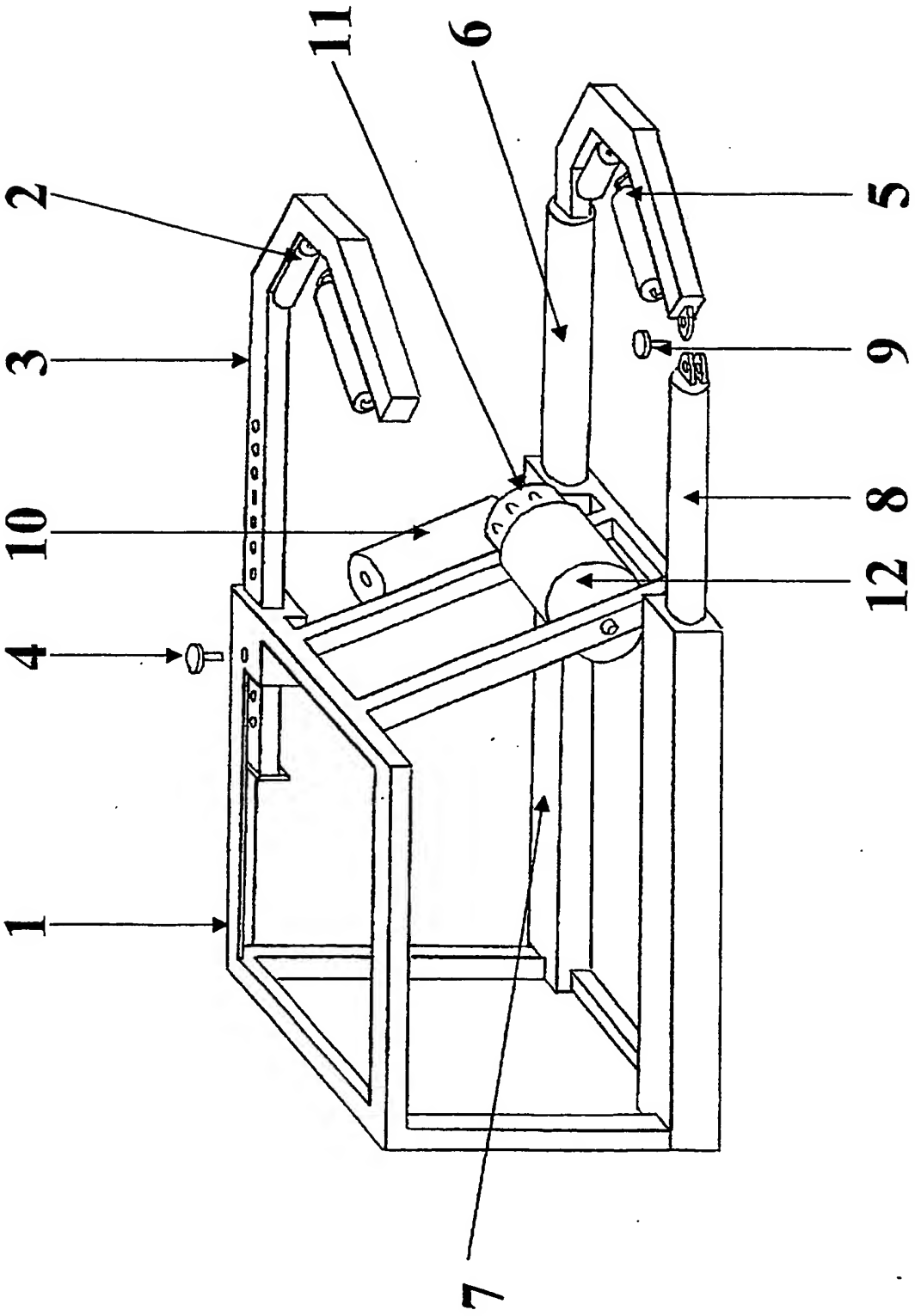


FIGURE 2

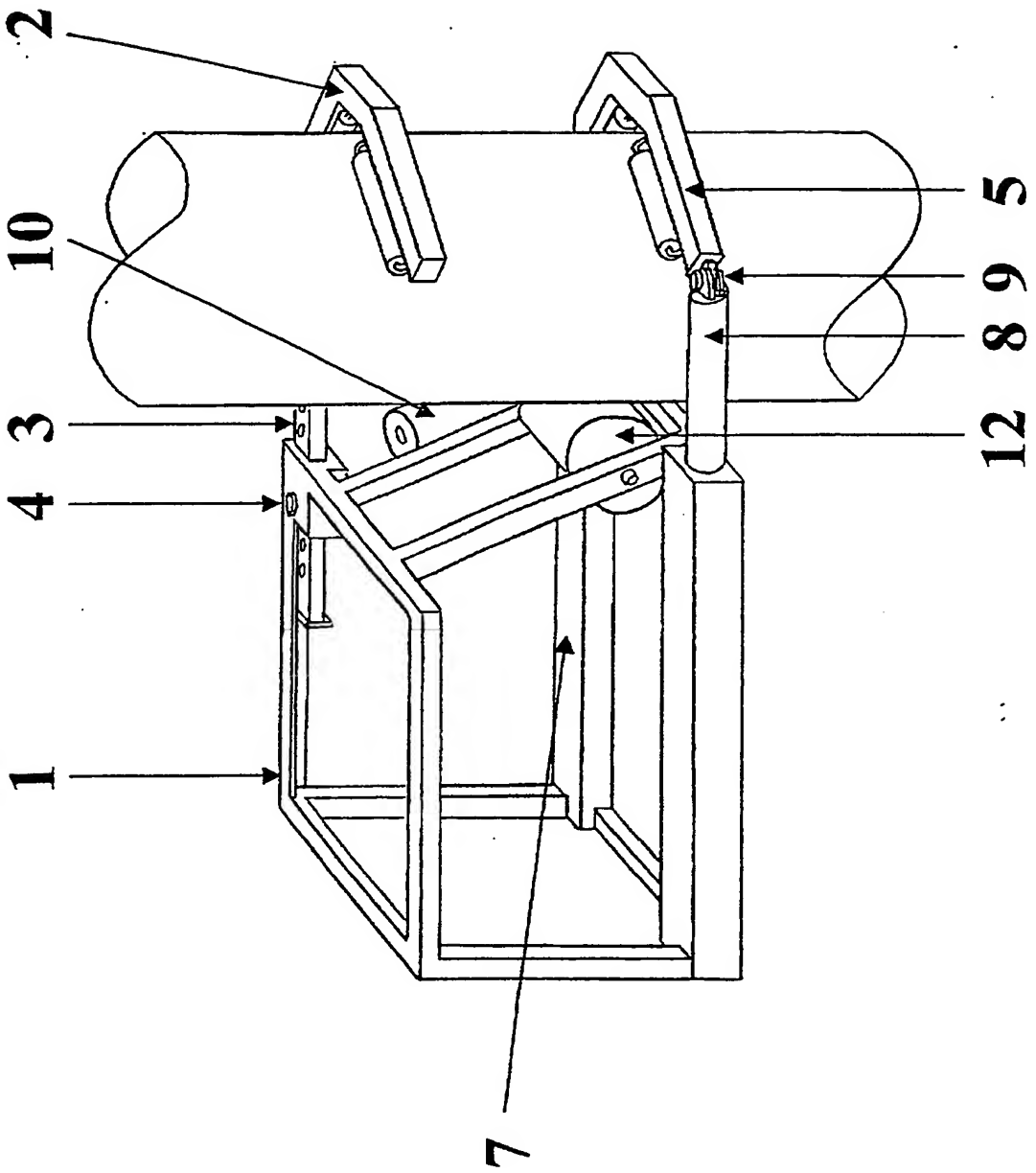


FIGURE 3

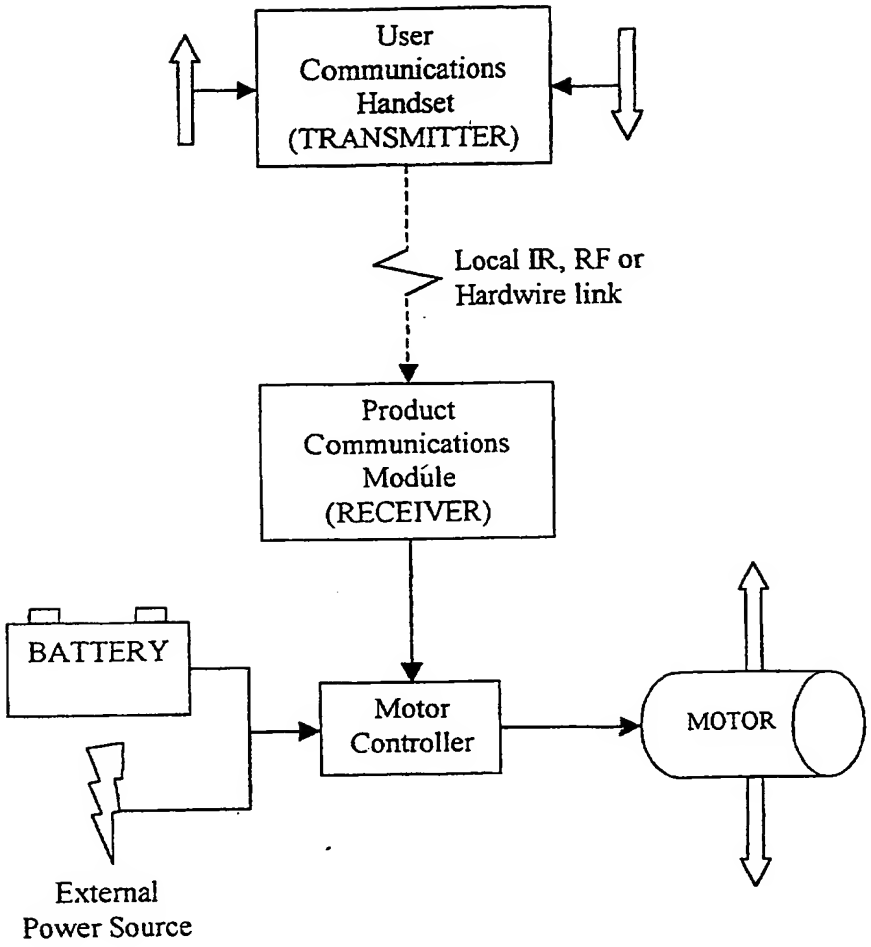

User Communications Handset (TRANSMITTER)
Local IR, RF or Hardwire link
Product Communications Module (RECEIVER)
BATTERY
Motor Controller
MOTOR
External Power Source

FIGURE 4

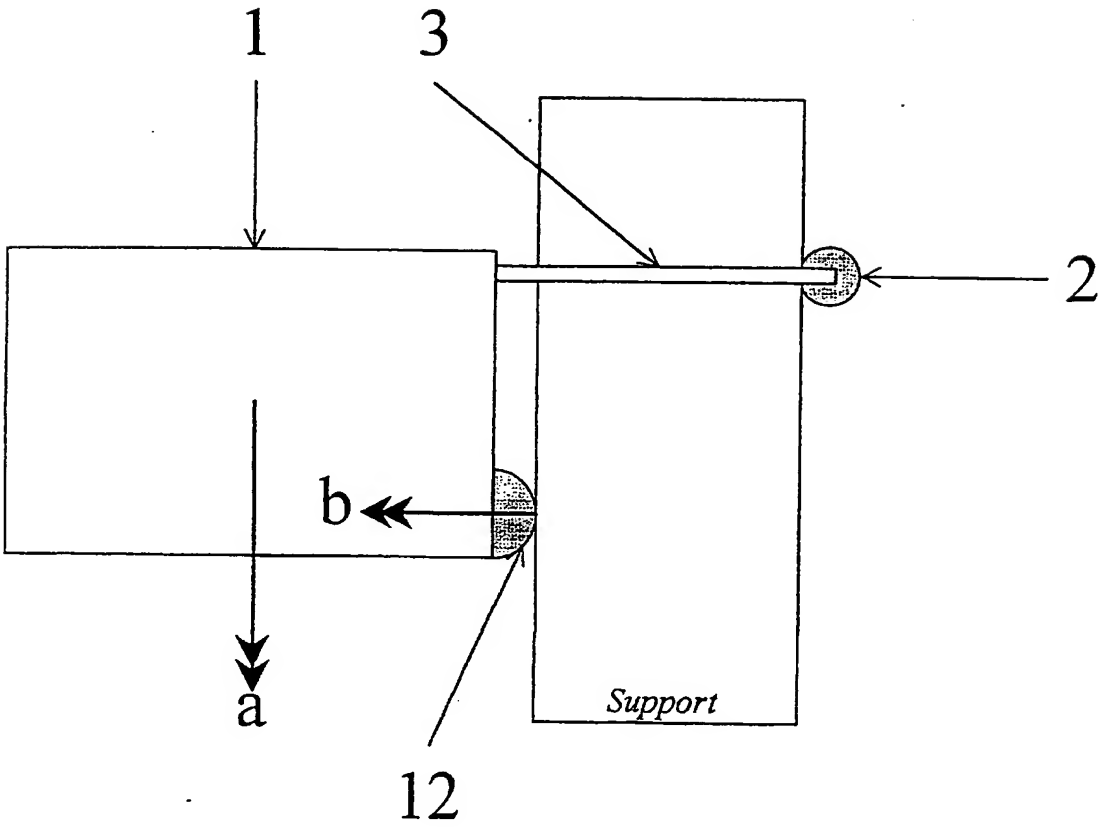


FIGURE 5

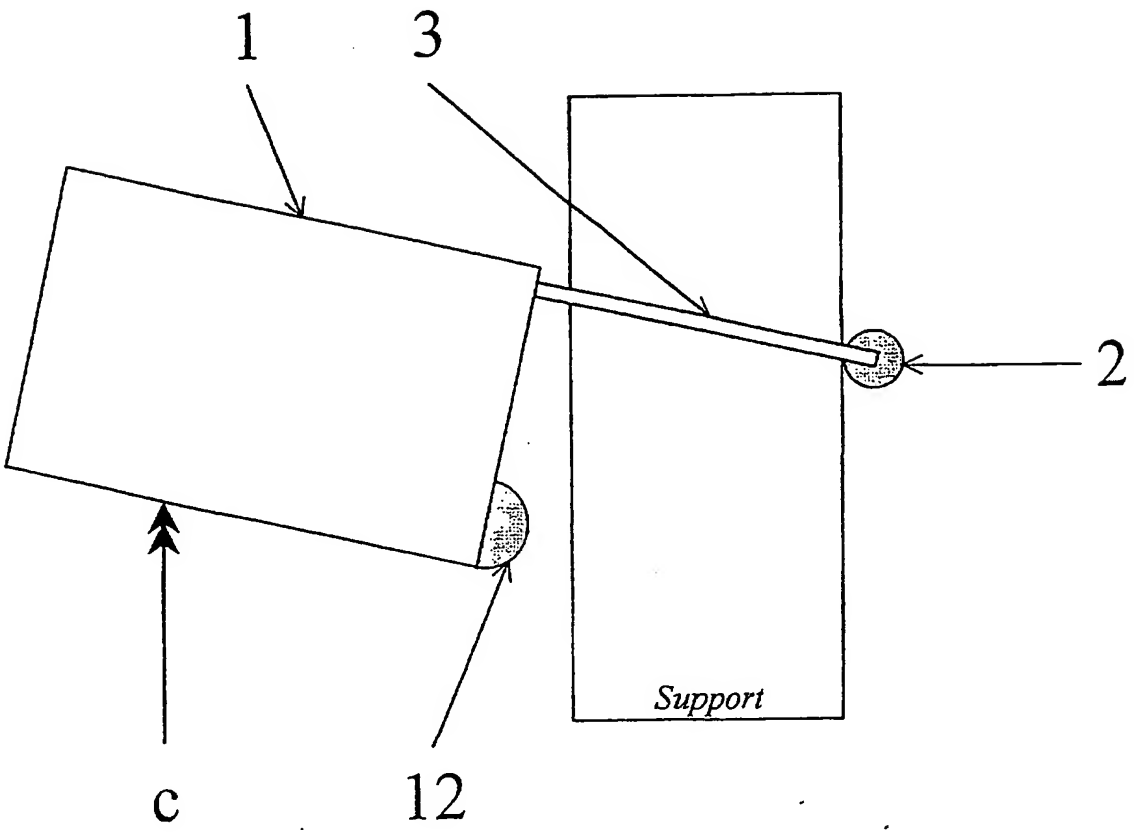
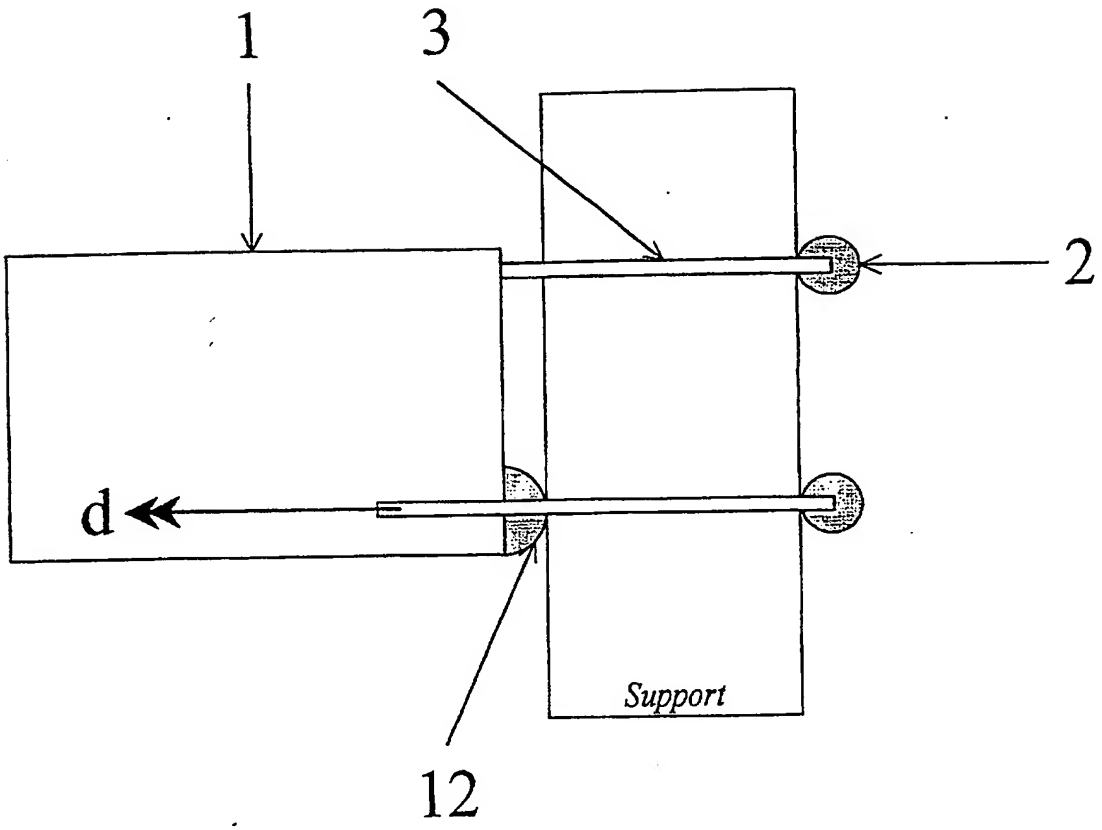


FIGURE 6



TITLE

Vertical climbing device for masts, poles or similar structures.

The invention relates to a method and means of deploying equipment on masts or like structures quickly, safely and securely (e.g. lampposts, streetlights, traffic signs, telegraph poles, flagpoles scaffolding etc.). It is an object of the invention to provide a device that can be deployed on the vast majority of post profiles and can accommodate a wide range of support diameters including tapering supports.

This object is achieved by the device according to claim 1. Such a device is highly adaptable and can be designed to carry functional equipment (e.g. camera, lens, pan and tilt, electronics and telemetry in the case of a CCTV system). However it is not limited to a specific role.

It is known that rapid and flexible deployment of high-tech equipment is increasingly required in both the public and private sector particularly with regard to the use of Closed Circuit TeleVision (CCTV). The invention has a number of unique advantages over fixed infrastructures. Typically these infrastructures are inflexible to changing demands placed upon them, capital intensive and reactive. For example, in the case of CCTV, large budgets and long project lead times are established to commission and install an infrastructure in an identified location specifically in response to a crime pattern or in the interests of public safety.

Importantly, the invention provides a versatile, cost effective, easy to use/maintain and proactive surveillance measure.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail with reference to the drawings, in which:

Figure 1 is a perspective view of a fully in accordance with one embodiment of the invention, broken away to reveal internal detail

Figure 2 is a similar view of the assembly deployed on a support

Figure 3 shows a flowchart of the electronics used to drive the unit

Figure 4 is a diagram showing the principal operation of the device of Figure 1

Figure 5 is a similar diagram showing potential instability of the device, and

Figure 6 is a further diagram showing a biased roller assembly that secures the unit to a structural support.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Figure 1 shows a preferred embodiment of the device. The protective panels and door to the rear of the unit have been removed to show internal details. Frame 1 is a rigid structural box made from box section members. It is designed to house the motor 10, gearbox 11, drive roller 12, batteries and electronics for the unit (not shown) as well as the functional hardware to be deployed. With a single degree of freedom, armature 3 is free to extend in and out of frame 1 and is designed to lock in place securely. This provides the unit with adjustment to fit the diameter of the support. In the preferred embodiment, a locking pin 4 has been used to lock armature 3 in place but a number of other suitable devices could also be used. Attached to armature 3 are the top roller pair 2, which locate on the opposite surface of the support to frame 1. Importantly, top roller pair 2 and lower roller pair 5 are aligned in V-shaped assemblies. Given that the unit climbs supports under remote control, the V-shaped roller arrangements allow the unit to self align itself with the support. The result is that the unit climbs vertically up the support, preventing yaw. Top roller pair 2 and lower roller pair 5 are V-shaped so that self-steering is effective on both ascent and descent of the support.

Armature 6 also extends from frame 1 but given it is made from a circular section member, it has an additional degree of freedom; rotation about its axis. Further, section 7 contains a force generating device that acts on armature 6 ensuring lower roller pair 5 are pulled in toward frame 1 at all times. In the preferred embodiment,

compression springs are used but alternative methods include tension springs, pneumatics, hydraulics, electric motors, other electromechanical devices and other mechanical fastenings. Sliding link 8 also extends from frame 1 and locks securely in place against lower roller pair 5. In the preferred embodiment, this is achieved with a locking pin 9 but a number of other suitable devices could also be used. Sliding link 8 ensures lower roller pair 5 remains horizontal and closes the loop made with lower roller pair 5 and armature 6 around the support. This prevents the support from leaving the face of the drive roller 12 during deployment.

Motor 10 is connected to the drive roller 12 via a worm-drive gearbox 11, thus preventing the drive roller from being back-driven once the motor is inactive.

DEPLOYMENT

An initial estimate of the support diameter is made and armature 3 is adjusted accordingly. Locking pin 4 is inserted to fix the position of top roller pair 2 relative to drive roller 12. Frame 1 is then inclined slightly to allow the unit to be hooked around the support. Once the support is centrally aligned between top roller pair 2 and drive roller 12, frame 1 is declined so that the unit comes to rest horizontally with top roller pair 2 and drive roller 12 touching the support. Holding lower roller pair 5 in between the two rollers and pulling, armature 6 can be extended and rotated to allow lower roller pair 5 to pass beyond the diameter of the support. Once clear, armature 6 can be rotated until lower roller pair 5 are horizontal. On release, force generator 7 will ensure armature 6 automatically retracts and maintains a force on lower roller pair 5 flush against the support. With the unit secure, sliding link 8 is extended and locked in place against lower roller pair 5 with locking pin 9. Figure 2 illustrates the unit attached to the support.

To deploy the unit, a simple remote link is used to drive the unit up and down the support. Figure 3 details the flowchart of the electronics used to communicate command signals from the operator to the motor, which in turn translates into movement of the unit up and down the support. Importantly, communication can be achieved using remote links to the unit or by means of a hardwire link and power can

be provided to the motor using either the on-board battery or an external power source (e.g. from the a vehicle battery, mains etc.).

PRINCIPLE OF 'SELF-HELP'

In Figure 4, top roller pair 2 are attached by armature 3 to the structural frame 1. Frame 1 contains the motor, batteries, electronics and ancillary functional equipment resulting in the Centre Of Gravity (COG) being displaced to one side of the support. The gravitational force on the COG (a) is used to create moment forces about the support and forms the basis of the self-help mechanism.

Taking moments about top roller pair 2, (a) is balanced by a reaction of the support against drive roller 12, (b). Drive roller 12 is made from a rubber with a high coefficient of friction allowing sufficient vertical forces to be developed against the surface of the support, thus balancing (a). By applying a torque to drive roller 12 via motor 10 and gearbox 11, the unit can be propelled up and down the support.

Self-help alone is unstable. Figure 5 shows how a sufficient relief force (c) applied in opposition to (a) could result in drive roller 12 separating from the support. In which case the unit would become unstable, lose the friction force through drive roller 12 and uncontrollably descend the support until such time as (c) is removed.

Thus, Figure 6 describes the final development of the principle. Lower roller pair 5 are connected to frame 1 using a armature 6 connected to a force generator 7 to create a force (d) of lower roller pair 5 against the support. The preferred embodiment in Figure 1 uses compression springs however other alternatives include tension springs, pneumatics, hydraulics, electric motor, electromechanical devices or other mechanical fastenings. This force (d) provided by lower roller pair 5 on the opposite side of the support results in drive roller 12 remaining in contact against the support even whilst (c), as mentioned earlier, is applied. Importantly, as the unit climbs tapering structures, force generator 7 takes up the taper whilst continuing to provide a strong stabilising force against the drive roller.

CLAIMS:

1. A transportable elevator device for ascending a mast, pole or similar vertical member, comprising a drive motor coupled to friction wheel or roller means via a mechanical transmission, guide means for embracing said vertical member in such a manner that the elevator device can be assembled to said vertical member with said guide means and said friction wheel or roller means respectively in contact with opposite sides thereof and in vertically spaced relation, and means for biasing said elevator device to retain said friction wheel or roller means in frictional contact with said vertical member whereby the elevator device can adopt a stable attitude on said vertical member with its vertical position defined by the friction wheel or roller.

2. A device according to Claim 1, wherein said means for biasing comprises the mass of a body of the elevator device which is arranged to apply a turning moment about said guide means to force the friction wheel or roller means against the vertical member.

3. A device according to Claim 2, wherein the position of said guide means is adjustable relatively to the body of the device.

4. A device according to any one of Claims 1-3, wherein said means for biasing comprises a supplementary guide means arranged to engage said vertical member at a point directly opposite said friction wheel or roller, means being provided for biasing said supplementary guide means towards said roller.

5. A device according to any one of Claims 1-4 including means for remotely controlling the operation of said drive motor.

6. A transportable elevator device substantially as described herein with reference to the accompanying drawings.

Application No: GB 9927601.6 **Examiner:** Darren Handley
Claims searched: 1-6 **Date of search:** 13 September 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): A6M MGA

Int Cl (Ed.7): A63B 27/00, B66B 9/16, B66F 11/04

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	EP 0542168 A1	(ALCEGARDEN) - see column 3, lines 2-32, column 4, lines 13-58 and column 5, lines 32-53.	1-3
X	WO 93/10658 A1	(LEMOYNE) - see guide wheels 3A-3D and drive wheel 6 figure 1 and page 9, line 23- page 10, line 24.	1-4
A	US 3727723 A	(PITCAIRN) - see column 2, lines 18-57 and V-shaped frame member 22, figure 2.	
X	BE 899371 A	(JANSSENS) - see motor driven wheels 3, 4 and guide wheel 6, figure 1.	1, 5

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.